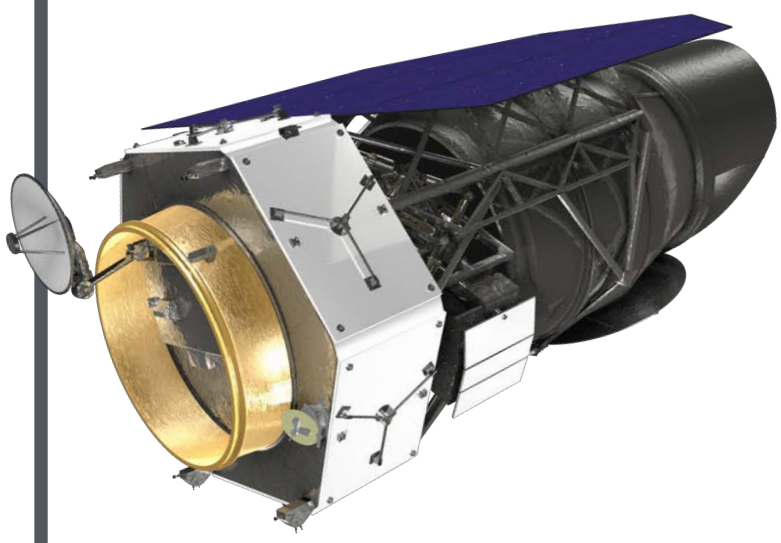
Continuing the Legacy of NASA's Great Observatories

The Wide Field Infrared Survey Telescope



WFIRST

The Wide Field Infrared Survey Telescope (WFIRST) is a Hubble-sized 2.4-meter aperture space observatory optimized for wide-field infrared astronomy (0.5-2.0 μm) and high-performance coronagraphy.

Potential Science Programs

- Measure the history of dark energy in the Universe
- Understand the fossil record of galaxy formation
- Establish the census of "cold" exoplanets
- Characterize the epoch of reionization
- Directly image and characterize faint exoplanets and disks
- Map the history of galaxy evolution over cosmic time
- Survey for planets and small bodies in the Solar System

WFIRST is NASA's next great observatory, designed to complement the capabilities of the Hubble, Spitzer, and James Webb Space Telescopes and the next generation of large ground-based facilities such as the Large Synoptic Survey Telescope (LSST). It is the first telescope to combine the strengths of NASA's flagship missions (high throughput and high-resolution imaging) with the strengths of our most powerful ground-based surveys (wide field of view). WFIRST offers Hubble sensitivity and 0.1 arcsec resolution over a 0.28 sq deg field of view that is 100x the field of Hubble's visible cameras. WFIRST is also equipped with a high-performance coronagraph that will be capable of suppressing starlight by factors of up to a billion to 1, to directly discover and characterize exoplanets. The mission is designed to enable cutting edge astrophysics through a General Observer and archival Guest Investigator program. WFIRST is slated to launch in the mid 2020s.

WFIRST Imaging Capabilities

Telescope Aperture (2.4 meter)	**Field of View** (45′x23′; 0.28 sq deg)	**Pixel Scale** (0.11 arcsec)	**Wavelength Range** (0.5-2.0 μm)

Filters	**R062**	**Z087**	**Y106**	**J129**	**H158**	**F184**	**W146**
Wavelength (μm)	0.48-0.76	0.76-0.98	0.93-1.19	1.13-1.45	1.38-1.77	1.68-2.00	0.93-2.00
Sensitivity (5σ AB mag in 1 hr)	28.5	28.2	28.1	28.0	28.0	27.5	28.3

WFIRST Spectroscopic Capabilities

	Field of View (sq deg)	**Wavelength (μm)**	**Resolution**	**Sensitivity (AB mag) (10σ per pixel in 1hr)**
Grism	0.28 sq deg	1.00-1.93	435-865	20.5 at 1.5 μm
Prism*	0.28 sq deg	0.6-1.8	70-140	22.6 at 1.5 μm

WFIRST Coronagraphic Capabilities

	Wavelength (μm)	**Inner Working Angle (arcsec)**	**Outer Working Angle (arcsec)**	**Detection Limit**	**Spectral Resolution**
Imaging & Spectroscopy	0.4-1	0.15 (exoplanets) 0.9 (disks)	0.9 (exoplanets) 3.0 (disks)	10^{-9} contrast (after post-processing)	~50

https://wfirst.gsfc.nasa.gov/science/WFIRST_Reference_Information.html

*Prism design parameters are still being optimized.

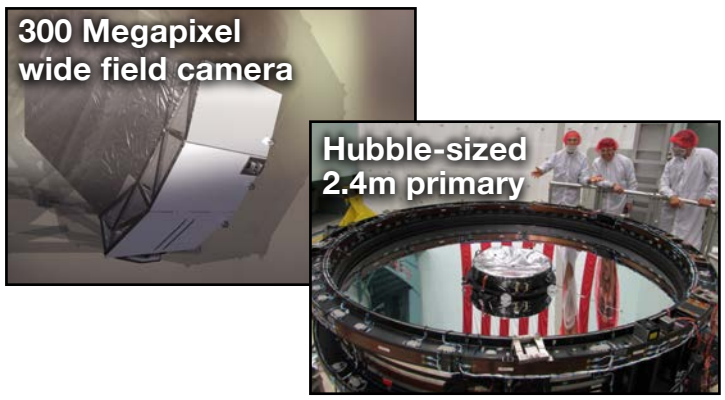
A New NASA Facility for the Entire Astronomical Community

100% of WFIRST's observing time is available
The specific implementation of core surveys and all General Observer time, as well as associated funding, remain to be competed and selected through peer review

The WFIRST science teams for the operational mission phase remain to be selected
The current Formulation Science Working Group (FSWG) will be disbanded in early 2021

All WFIRST data will be publicly available with no period of limited access
Selected science teams will help define the WFIRST observing plan, but all data will be public to anyone

Big Data Space Astrophysics



Possible Survey Implementations

High Latitude Survey (2000 sq deg at 27th mag in YJHF184 + spectra)
Dark Energy — Cosmic Lensing — High-z Galaxies — Galactic Halo Substructure

Deep Field Surveys (~10 deg^2 fields at 28-29th mag, with high cadence)
Supernova Discovery — First Light — Galaxy Evolution

Galactic Bulge Survey (2.2 sq deg at high cadence)
Exoplanet Census — Free Floating Planets — Stellar Pops — Galactic Structure

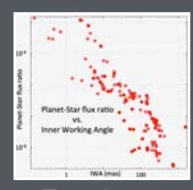
Exoplanet Survey (10^{-9} contrast ratio direct imaging and spectroscopy)
Exoplanet Discovery and Characterization — Disks — Massive Star Atmospheres

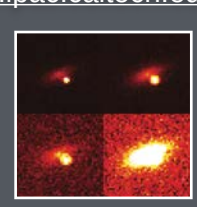
Following the tradition of other NASA Great Observatories, WFIRST will offer funded **General Observer** and **archival Guest Investigator** programs for all community (peer-review selected) science projects.

WFIRST Tool Kit for Building Science Simulations

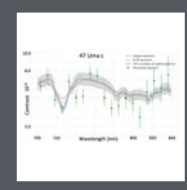
Simulation Tool Kits Now Available at WFIRST Science Centers
Science Planning Toolbox at http://www.stsci.edu/wfirst/
https://wfirst.ipac.caltech.edu/sims/Simulations_csv.html

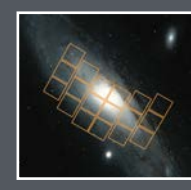

Wavelength Dependent PSF Simulator

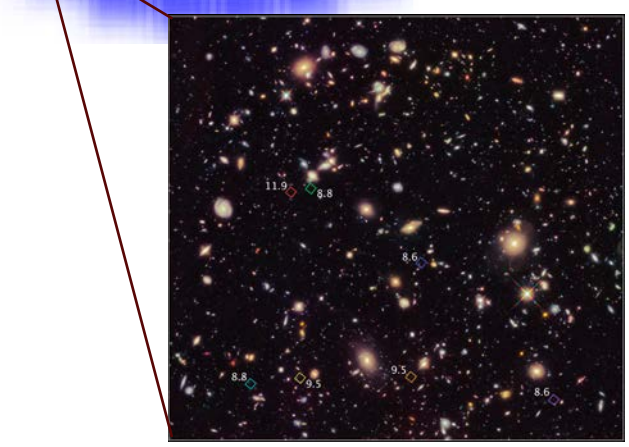

Exoplanet Yields Simulator


3-Dimensional Exposure Time Calculator

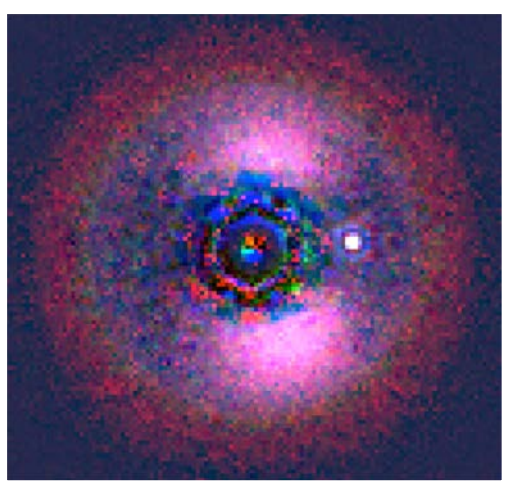

Stellar Pops Image Simulator


CGI Spectral Simulator

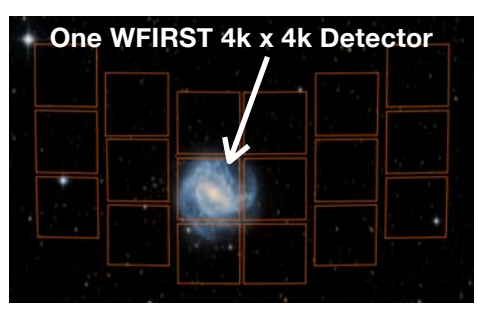

Multi-mission Field of View Overlay



The blue footprint shows a simulated WFIRST 50-dither WFI exposure. The red overlay is the size of the Hubble Ultra Deep Field. A WFIRST Ultra Deep Field would be 100x wider than Hubble and JWST surveys, with >100 galaxies at z > 10.



A WFIRST coronagraphic simulation of a warm Jupiter at 2 AU from a G2 star at d = 3 pc. WFIRST's high performance coronagraph aims to reach 10^{-9} contrast ratio in the visible, orders of magnitude better than current ground or space capabilities.



Single WFIRST fields will probe the entire visible extent of all nearby galaxies and >50 kpc of their halo (at 4 Mpc).

For more information please visit, https://wfirst.gsfc.nasa.gov